IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Lu et al.

Serial No. :   09/748,832

For: METHOD AND SYSTEM FOR VIDEO TRANSCODING

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Examiner: Tung T. Vo

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Commissioner of Patents
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DECLARATION UNDER 37 C.F.R. §1.132

Dear Sir:

1.   I, Ligang Lu, an applicant in the above-identified patent application, hereby declare and state the following:

2.   I received a Ph.D. in Electrical Engineering in 1995 from Rensselaer Polytechnic Institute in Troy, NY. I have been associated with the IBM T.J. Watson Research Center in Yorktown Heights, NY, as a research staff member conducting research and development in multimedia technologies, from 1997 to the present. I have extensive knowledge and experience in multimedia

systems, including areas such as video and image signal processing, compression, communication, MPEG, H.26x, JPEG, JPEG2000, vector quantization, transcoding, scalable coding, rate allocation, error resilience and correction, multiple description transmission, joint source-channel modeling, filtering, segmentation, scene and edge detection, and perceptual video quality matrix.

3.   I am a co-inventor of U.S. Patent Application Serial No. 09/748,832, filed on December 27, 2000.

4.   Claim 1 in U.S. Patent Application Serial No. 09/748,832 discloses a look-ahead estimator that gathers information from a compressed video signal prior to input to a decoder, and further discloses using future signal characteristics. Similarly, claim 9 discloses looking ahead to one or more future pictures, which are in the compressed video signal prior to input to the decoder.

5.   Nilsson discloses a transcoder having a decoder and an encoder. An incoming video signal is coded with a motion compensation coding scheme, which is decoded by the decoder. The encoder encodes the output of the decoder according to a second coding scheme employing motion compensation. At least some frames are coded using motion-compensated inter-frame predictive coding.

6.   Nilsson does not disclose or suggest the look-ahead estimator of claim 1 nor the step of looking ahead recited in claim 9. Particularly, the motion estimator of Nilsson is not a look-ahead estimator. Nilsson does not disclose a "future picture" as recited in claims 1 and 9, and further does not describe gathering information from a compressed video signal prior to decoding.

7.   In video compression, a widely used technique is **motion compensated inter-frame predictive coding**, which includes standards such as

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MPEG-1 and H.261. Both the input and output signals of the transcoder of Nilsson are encoded with this technique.

8.   It is noted that the terms future, current and previous refer to an order in which frames, i.e., pictures, are decoded in the transcoder. Thus, "future pictures" or "future frames" and "future signal characteristics" refer to pictures in the incoming video signal that have not yet been decoded. The terms "current picture", "current frame" and "current signal characteristics" refer to the current picture and current signals being actively and currently decoded by the transcoder. "Previous frames" or "previous pictures" refer to pictures that have been decoded prior to decoding of the current picture.

9.   Inter-frame predictive coding uses a **previous frame** as a predictor (or an estimate) of the **current frame**, i.e., the frame being coded, and only encodes and transmits the pixel value difference, i.e., the prediction error, between the current frame and the previous frame. The decoder decodes the received prediction error and adds it to the previous decoded frame to reconstruct the current frame.

10.   Because in video there are objects moving from frame to frame, it is more efficient to use motion-compensation in inter-frame predictive coding. Motion estimation is accomplished using a motion estimator. To encode a block of pixels, i.e., the current block, in the current frame, the motion estimator searches the previous frame to find the current block's best match, i.e., the **best predictor**, that minimizes the difference between the block of the previous frame and the current block. The displacement between the location of the current block and the location of its best match in the previous frame is the **motion vector**. The difference between the current block and its best predictor in the previous frame is called the motion compensated prediction error, which is coded and transmitted along with the motion vector.

11.   The best predictors (or best matches) for all blocks in the current frame form a motion-compensated **predicted frame** which is an estimate of the current frame. The difference between the current frame and the motion compensated predicted frame is called the motion-compensated frame difference. In motion-compensated inter-frame predictive coding, this motion-compensated frame difference along with all the motion vectors used in forming it are coded and transmitted.

12.   When the signal is to be decoded, the decoder decodes the received motion compensated prediction error and the motion vector, using it to find the best predictor in the previous frame that has been previously decoded, then adds the decoded prediction error to the best predictor to reconstruct the current block.

13.   Thus, the function of the motion estimator of Nilsson is to find the motion vector for a current block from a previous frame. Therefore, structurally the motion estimator can only involve the current frame and the previous frame(s). A predicted frame, as disclosed in Nilsson and understood in the art, is an estimate of the current frame, which is the motion compensated previous decoded frame. Therefore, the predicted frame is not a future frame. Also, because Nilsson discloses only coding using motion compensated inter-frame predictive coding, Nilsson does not disclose gathering information from a future frame.

14.   The Examiner states that "at least one other frame," disclosed at col. 2, lines 61-67, is a future frame. As discussed above, motion compensated inter-frame predictive coding uses only a current frame and one or more previously decoded frames. In Nilsson col. 2, lines 61-67, "at least other frame," from which motion vector processing or motion estimation means and predictive coding can be used for a current frame, is a previously decoded frame. This " other frame" is not, and can not be, a future frame.

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15.   As discussed above, Nilsson only discloses coding pictures according to information in a current frame and a previously decoded frame. Nilsson does not disclose gathering information from a frame while the frame is part of the compressed input video stream. Therefore, Nilsson <u>does not disclose gathering information from, or looking ahead to, future pictures in the compressed video signal before they are decoded</u>, as provided in claims 1 and 9.

16.   Contrary to the Examiner's statements, motion vectors MV1 and MV'1, shown in FIG. 3 of Nilsson, do not represent information from the incoming compressed video signal. Fig. 3 in Nilsson is a transcoder arranged to receive a signal encoded according to ISO/IEC standard 11172-2 (known as MPEG-1) (col.6, line46-51). In MPEG-1, motion vectors are coded using predictive and variable length coding (VLC) (See Pages D39-D41, ISO/IEC 11172-2 MPEG-1). Therefore, it is impossible to extract motion vectors without decoding first, and thus Nilsson's Fig. 3, and the accompanying description, is incomplete. Nilsson incorrectly omits mention of a means to decode MV1 and MV'1. Thus, <u>Nilsson does not disclose using information from a compressed signal prior to decoding</u>.

17.   Accordingly, it is clear that the claimed device having "a look-ahead estimator to gather information from said input compressed video signal prior to input to said decoder to estimate future signal characteristics of one or more future incoming pictures, and to gather information from said decoder to estimate current signal characteristics of a current picture," as recited in claim 1, and the claimed method including "looking ahead to estimate complexities of one of more future pictures or portions thereof, said future pictures in said compressed video signal prior to input to said decoder," as recited in claim 9, is not disclosed or suggested by the cited and relied upon Nilsson.

18.   I further declare that all statements made herein to the best of my knowledge are true and that all statements made on information and belief are

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believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Declared at ___Yorktown Heights NY___, on this __29__ day of June, 2005.

Signature:___Ligang Lu___

Ligang Lu

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